High-Speed Diffraction Probe

High-resolution materials characterization and processing diagnostics in milliseconds

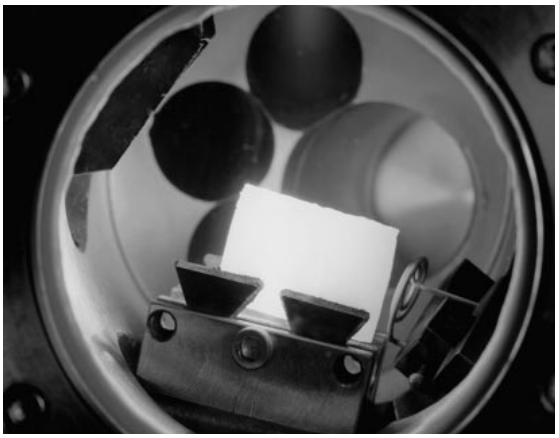
We have developed a real-time, x-ray diffraction technique to characterize material phases in situ under processing conditions. With this instrument (one of *R&D Magazine's* 100 award-winning technologies), we can diagnose technologically important materials syntheses and processings—such as combustion synthesis and fusion welding—in milliseconds.

A high-intensity, x-ray source generated from a synchrotron storage ring serves as the probe source. The probe stimulates a diffraction pattern from the material of interest, which is recorded with a position-sensitive silicon photodiode array. By using a focused synchrotron x-ray beam, spatial resolution can be obtained to a few hundred microns. Phase mapping can then be performed in multicomponent materials in situ and at temperatures encountered during the actual fabrication process.

This combination of rapid data turnaround and superb spatial resolution promises improvements in materials characterization and processing diagnostics not possible with conventional techniques.

APPLICATIONS

- *In situ catalysis studies*
- *Phase transformation*
- *Thin-film deposition*
- *Combustion synthesis*
- *Fusion welding*



High-intensity characteristics of synchrotron radiation can reduce measurement time from hours to sub-seconds.

Experimental capabilities

- Detection modes: simple θ to 2θ geometry with a photodiode array
- Samples types
  - — Bulk solid and powder
  - — Thin films
- Time resolution: milliseconds
- Spatial resolution
  - — 250 µm with second-generation synchrtron sources
  - — 1 µm with third-generation synchrotron sources

Availability: This technology is operational now. We can provide on-line, rapid turnaround material structure and processing diagnostics to aid in materials problem-solving.

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